Soil Conservation

October 1978

U.S. Department of Agriculture

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Meeting the Challenges of the Rural Clean Water Program

From the Administrator

The roles of State soil and water conservation agencies and State water quality agencies, conservation districts, and SCS in implementing Section 35 of the Clean Water Act of 1977 are much discussed these days.

But little is heard about the important role of another participant in the effort—the land improvement contractor. The need for construction technology and talent in soil and water conservation activities will increase as the Rural Clean Water Program (RCWP) gets underway.

Private land owners and operators who voluntarily enter into long term, cost-shared contracts under RCWP will need help from contractors on the structural measures needed to prevent or reduce nonpoint agriculture-related pollution of our Nation's waters. Some will need help with installing, operating, and maintaining best management practices (BMP's).

Although BMP's often include soil conservation measures familiar to land improvement contractors, these improved systems also include other practices not so familiar. Private landowners will engage contractors, as needed, to carry out work under the contracts, subject to standards and specifications established by SCS.

As we embark on the new water quality program, we are fortunate to have available the largest pool of land improvement contractors in our history. The growth of the group has paralleled and been a part of the development of the conservation movement in the Nation.

By 1951, there were enough contractors specializing in land improvement all over the country to found their own national organization, the Land Improvement Contractors of America (LICA). Contractors are organized in 39 States, including 5 New England States combined in a single chapter. The national group today has more than 3,400 members.

Some of the contractors started out as farmers, then began construction work part time. Many continue farming and many are small, independent operators, with a personal stake in the well-being of rural America.

SCS and LICA share many common objectives for conservation of land and water resources, and our working relationship is well established. For the past 16 years, for example, we have shared a responsibility for training contractors in new conservation techniques and procedures by jointly sponsoring an annual series of winter workshops in all sections of the country.

We should strive to improve and strengthen our communications and relationships to assure the success of the Rural Clean Water Program and other activities. SCS, conservation districts, and land improvement contractors have an obligation to cooperate closely to meet the challenges ahead.

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A soil scientist dips soil samples to coat them with saran to stabilize them and to retain moisture. (Photo, John Cross.)

Back cover:
A physical science aide removes a soil sample from the drying room at the National Soil Survey Laboratory. (Photo, Gene Alexander.)
See article beginning on page 4.

Unearthing the Soils' Secrets

by John M. Cross

National Soil Survey Laboratory scientists help soil scientists in the field by making detailed soils studies. They also develop better ways to predict soils' performance and techniques for using soils data in evaluating potential uses of soil resources.

Soil scientists have a lonely job. They go out into the fields to map the soils with only the few pieces of equipment they take with them. Sometimes the soils are reluctant to give up their secrets and sometimes they don't fit into neat categories.

That's when soil scientists need help. In the 1950's, the Soil Conservation Service established three soil survey laboratories to help SCS soil scientists with their field work. In 1975 and 1976, the three laboratories —which were located in Riverside, Calif.; Beltsville, Md.; and Lincoln, Nebr.—were consolidated into the new National Soil Survey Laboratory (NSSL) at Lincoln.

Every year, the 19 NSSL scientists and their supporting staff make more than 75,000 soil analyses, supply data and technical assistance on hundreds of soil survey problems, conduct dozens of detailed soil studies, and develop techniques for using soils data in evaluating potential uses of soil resources. They also have leadership in developing and improving methods of soil analysis and in coordinating procedures used by other soils laboratories.

When SCS soil scientists need information to supplement their field measurements of soil properties, they send soil samples to the NSSL for quick physical, chemical, and mineralogical analyses. When laboratory analyses alone are not adequate, the NSSL scientists perform field investigations, particularly in areas of unusual geology.

Some questions about soils cannot be answered easily. As landowners and others become more and more concerned about natural resources, they need new and more accurate soil performance predictions. As a result, soil scientists at NSSL have developed new equipment that will provide additional field measurements during soil mapping. Reuben E. Nelson recently perfected a simplified field kit for rapidly evaluating soil salinity and sodium content. George Holmgren developed a sophisticated kit for making field measurements of chemical properties. Holmgren's kit is now widely used across the Nation by SCS soil scientists and others.

Many soils problems require combined field and laboratory studies. Currently, NSSL Soil Scientists Robert B. Grossman, Ronald F. Paetzold, and Sam J. Ross are working with USDA's Science and Education Administration scientists to develop more precise field and laboratory measurements of water transmission and storage properties of soils. Other NSSL scientists work with soil scientists from SCS Technical Service Centers and State and local offices to study soil distribution patterns. These efforts increase the efficiency and accuracy of ongoing soil surveys.

In addition to helping soil scientists with their field work and solving

At left, a block of undisturbed soil is removed from a 7-foot-deep pit. The soil sample will be sent to the National Soil Survey Laboratory for analysis.

NSSL Soil Scientists Sam Ross (left) and Dennis Nettleton measure and record the gross weight of a field sample before it is analyzed in the lab.

specific soils analysis problems, NSSL is compiling a library of soils data. The laboratory performs detailed measurements on representative soils across the country. The laboratory's goal is to collect and store on a computer a complete array of data on at least 20 percent of the Nation's 12,000 soil series and selected data on the rest.

Another goal of the laboratory is to establish a national data bank to store NSSL data and data provided by the SCS Soil Mechanics Laboratory (SML) at Lincoln and other laboratories. The data bank will be available to anyone studying soils.

Some of the soils data that will be collected include: salinity, sodium-calcium ratio; potential for retaining nutrients; amounts of nitrogen, organic carbon, and iron; water retention; density; shrink-swell capacity; acidity and alkalinity; and texture. The SML will contribute results of engineering tests.

NSSL and SML scientists often combine their efforts. For example, they work together to identify unstable or dispersive soil materials at potential dam sites. SML developed a technique for testing such dispersive soils and NSSL provided staff assistance and data. The two laboratories provide combined physical and chemical measurements on materials from sites with possible dispersion problems. In turn, SML helps the soil survey program by running engineering tests on samples submitted to NSSL.

Data are sometimes required when soil survey and water quality concerns merge. In one instance, NSSL provided information about the mineralogy of sediments from the Columbia River near Portland, Oreg., that helped identify the upstream sources of those sediments.

Cooperative studies of regional problems sometimes involve several institutions. Increased mining activities in the Northern Plains give new impetus to questions about how much moisture can be stored and supplied by various kinds of soft rock materials. Montana State University is studying this problem with assistance from SCS. NSSL is providing data to help interpret the results. SCS has collected some related data in North Dakota in a combined effort by SCS personnel from North Dakota and NSSL and staff from North Dakota State University. Similar efforts are planned in other States where moisture storage and transmission properties of highly weathered rocks influence water movement and the moisture supplied to plant roots.

SCS depends heavily on research by other agencies. NSSL scientists are responsible for using the research of others and extending the applications of the results. This extension is made possible by a collection of standard data that allows one soil to be compared with another. By

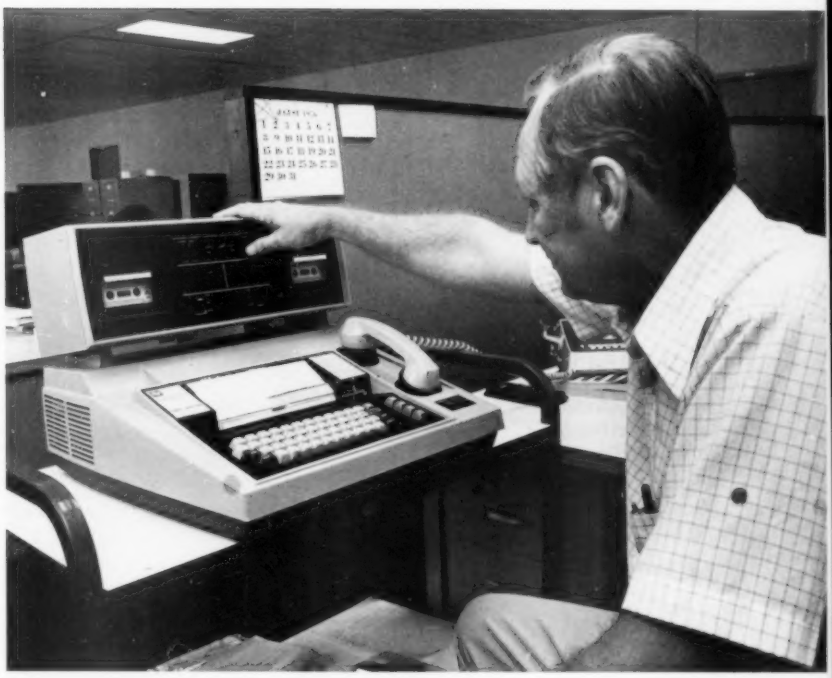
At right, Soil Scientist Nettleton screens a soil sample to remove stones. Far right, the soil scientists bag the labeled soil sample which scientists at the soil survey laboratory will analyze for salinity, organic content, texture, and other characteristics.

The laboratory's goal is to collect and store on a computer a complete array of data on at least 20 percent of the Nation's 12,000 soil series and selected data on the rest.

carefully selecting key properties of the most critical values, it is possible to develop a library of information from which more and more complex and precise predictions can be made. By following research results of other agencies, more and more uses can be made of the standard data.

Every day, cartloads of 10-pound bags of soil arrive at the NSSL. They are parceled out to scientists armed with microscopes, spectrometers, titrators, chromatographs, and other equipment. They yield their secrets to the scientists who are looking for better ways to predict the soils' performance in order to help resource planners better protect and use the soils.

Mr. Cross was head, information staff, Midwest Technical Service Center, SCS, Lincoln, Nebr., and is now retired.

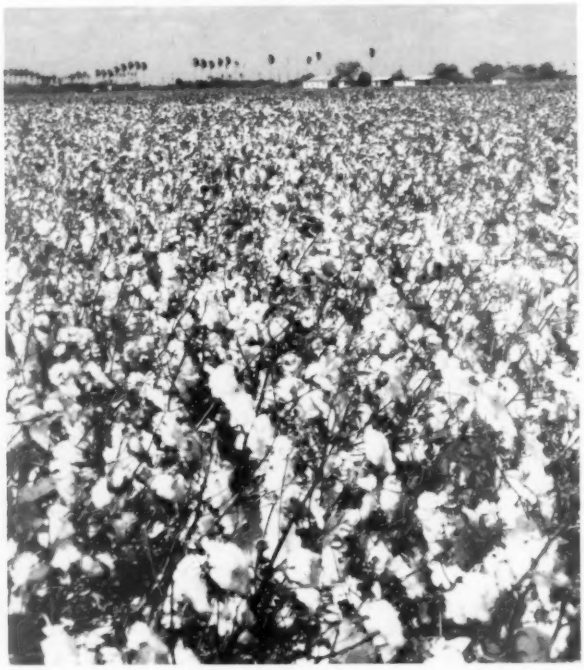


Above, NSSL Soil Scientist Benny Brasher transmits soils data to the University of Nebraska for processing. At left, Fern Adams, physical science technician, loads automatic samples changer for atomic absorption apparatus.

Rio Grande Delta: A Soils Sampler

In the Lower Rio Grande Valley in Texas, the information in SCS soil surveys helps in managing the valley's varied soils and their many uses.

by Harold W. Hyde



The subtropical climate and long growing season in the Lower Rio Grande Valley help make it one of the leading areas of agricultural production in the Nation. On the fertile, level soils farmers produce cotton, citrus fruits, vegetables, and other crops.

The soils of the Lower Rio Grande Valley of Texas are the offspring of two unpredictable parents—the Rio Grande River and the Gulf of Mexico.

Enroute to the Atlantic Ocean from the Rocky Mountains, the churning, turbulent Rio Grande River has carved out canyons and gorges as deep as 1,700 feet through solid rock. As the river merges with the sea, it deposits material in the Lower Rio Grande Valley, forming a delta that covers 3,000 square miles. As a result, soils in the valley range from heavy clays to deep sands, and in places, sediments are several hundred feet thick.

Southeast winds blow inland daily from the gulf influencing the climate and vegetation. The winds affect soil development by depositing sediment through tide and wave action.

A large sand sheet formation on the northern boundary of the Rio Grande Valley is made of sandy soils

At right, periodic flooding is a problem for farmers in the valley. These workers are taking cabbages from the field with a helicopter because the soil is too wet to support harvesting machinery. Far right, besides making it difficult to carry on routine farm work, flooding caused by hurricanes accelerates erosion and silting.

that extend inland from the coast for 80 to 100 miles northwest. The origin of the sands has not been fully determined, but they may have been carried from the shoreline by the gulf winds.

In the Lower Rio Grande Valley, the soils, the river, and the sea present several problems for conservationists: the threat of periodic floods, poor drainage, salinity, and threats of winter freezes or summer hurricanes. Many of the problems are associated with the level terrain that is only a few feet above sea level and the erratic weather in which droughts may be followed by heavy rains.

The torrential rains that accompany hurricanes cause extensive flooding and result in silting, accelerated erosion, and sandbar formation along the shorelines and river flood plains. Flooding and property damage may occur inland for several miles. A single hurricane can change weather patterns for hundreds of miles inland.

Three Texas counties—Cameron, Willacy, and Hidalgo—make up most of the lower part of the Rio Grande Valley. Hidalgo, the largest county, is almost 1 million acres in size. Willacy County is so flat that it is said to be the only county in the United States that does not have a named stream in its boundaries.

The area is served by three active conservation districts. The Southmost Soil and Water Conservation District (SWCD) serves Cameron County. The other two are the Willacy SWCD and the Hidalgo SWCD.

Soil Conservation Service soil scientists are currently making soil surveys of Willacy and Hidalgo Counties. SCS released a published soil survey of Cameron County in May 1977.

Soils information is badly needed in the valley. One reason is the intensity of farming in the area. The Lower Rio Grande Valley of Texas is one of the Nation's leading agricultural areas. Another reason is that this is one of the fastest growing areas in Texas. Urban expansion is rapidly covering the fringe area around the major cities and towns. The complexity of soils and the urban flood hazards increase the need for soil surveys.

The Rio Grande is a source of another problem affecting conservation practices. The river and its tributaries carry toxic salts from the arid regions of the Southwest and Mexico. In earlier years, irrigation with this water deposited excessive salts on fields and orchards. But in recent years, dams have been constructed in Northern Mexico to divert some of the saline tributaries.

The nearly level topography, low elevation, and lack of drainage outlets make removal of the salts difficult. High water tables add to the problem. The installation of under-

At left, violent hurricanes originating in the Gulf of Mexico cause extensive flooding in the valley about every 10 to 20 years. Shown is flooding from Hurricane Beulah in 1967. During other times, irrigating suitable areas with water from the Rio Grande River (at right) helps make the valley highly productive.

ground tile drainage lines has helped remove part of the excess water and toxic salts. Soil surveys are used to determine the spacing of drainage lines. Soil survey maps help in locating clayey soils in the valley that are not permeable enough for drainage lines to be installed.

In an area of extensive row and flood irrigation, fields and orchards must be almost level. Soil survey maps are also used to determine which soils are suitable for leveling.

Most of the irrigated land in the valley is concentrated within 60 to 70 miles of the river and the ocean. The soils on the boundaries of the irrigated area are used for dryland crops and rangeland. In places, the rangeland has large amounts of desert-type shrubs, brush, and trees. Some of this acreage is now being cleared and seeded to pasture grasses. Other cleared areas are being converted to cropland. Soil survey maps are used to help determine the feasibility of land use changes.

Uses of the soils in the valley are as varied as the soils themselves. Unlike any other part of Texas, palm trees dot the flat horizon where they grow among citrus orchards and truck farms. Where irrigation water is plentiful and soils are productive, farming is intensive and highly specialized. Areas in the valley where the water runs short are used for productive rangeland. In addition, there are several wildlife refuges, State parks, and beaches crowded with tourists. Wildlife includes deer, coyotes, and Texas-sized rattlesnakes. White-winged dove attract hunters from several States.

Farmers began irrigating cropland in the valley in the 1890's using water from the Rio Grande. Cotton and vegetables, some of the first irrigated crops, are still important crops in the area. Citrus trees were introduced in the early 1900's. Production of citrus, mostly grapefruit and oranges, is about 18 million boxes each year. Sugar cane, grain sorghum, and seed corn are also prominent crops.

The climate, the ocean, and recreation have made the valley a haven for tourists. During winter the area's population of 450,000 swells to almost 650,000.

The river and the sea have influenced not only soil development and conservation practices, but also the livelihood of local people, both in the past and present. Economic and agricultural development is also related to the climate, soils, and water resources.

Soil surveys help in managing the varied soils of the Rio Grande Valley. But the river and the sea will always affect those who live there.

Mr. Hyde is a soil scientist, SCS, Edinburg, Tex.

Far left, soil survey maps help farmers and ranchers avoid areas of excess salinity like this in selecting new sites for pastures and crops. Left, most citrus orchards in the valley are flood irrigated with water pumped out of the Rio Grande River and into concrete-lined channels.

Soil Survey Wins Popularity Contest

by Roger Howell

A strong information campaign turned a soil survey into a "best seller."

Above, Don Pennington (left), senior planner of the Washtenaw County Metropolitan Planning Commission, and SCS District Conservationist Clark Eacker discuss a soil classification factor map. The commission has made several different factor maps, using the Washtenaw County Soil Survey, to help in countywide land use planning and in helping township planning commissions. Below, the soil survey also provides information the county planning commission can use in protecting prime farmland from urban sprawl.

Fourteen years ago, urban development was increasing and land uses were changing in Washtenaw County in southeastern Michigan. Urban and industrial development were eating up prime farmland. Developers and landowners needed guidance to avoid costly land use mistakes.

Today, the Washtenaw County Soil Survey is helping developers evaluate building sites based on soil characteristics. Developers are using the soil survey information to choose sites for houses where septic tank filter fields will function properly and basements will be dry. In addition, prime farmland is being saved from development.

The Washtenaw County Soil Survey is a standout as one of the most popular of Michigan's soil surveys. In just 6 weeks after the survey's availability was announced at a first issue ceremony in August 1977, SCS filled requests for 1,500 copies.

The survey was a joint effort of the Soil Conservation Service, the Washtenaw County Board of Commissioners, and the Michigan Agricultural Experiment Station. Those involved in the survey work agree that the need for the survey, the widespread use of interim reports before the survey was completed, and a strong publicity campaign made the Washtenaw County Soil Survey a "best seller" in the community.

"No one would be using the survey if they didn't know about it," said Clark Eacker, SCS district conservationist in Washtenaw County. "I firmly believe the key to interest in the soil survey is the continuous public exposure it received. We maintained a strong soil survey information program ever since the first auger full of soil was examined in 1968. Actually, distribution now is the easy part because people know about the survey and they want it."

"I remember a case where a house was built on a hillside in the summer and the next spring the owner couldn't keep the basement dry with two pumps."

"The soil survey was well publicized and we included it in the Washtenaw County Soil Conservation District's (SCD) education program," said William Fishbeck, chairman of the Washtenaw County SCD board. "The district had soil displays at all the county fairs and we kept people informed about the soil survey in the district's newsletter. We sponsored a special meeting for interim soil survey users and are planning to hold another series of user meetings.

"We were opportunists," Fishbeck continued. "We took advantage of all kinds of situations to tell people about the soil survey, its value, and uses. Eacker made guest appearances on radio and television programs and spoke at service club meetings.

"The district also encouraged assistance from others in spreading the news about the survey. The Metropolitan Planning Commission was a big help. They had several displays and made a slide program on soils to help promote the soil survey. County newspapers helped too. All they needed was Eacker to call them up with an idea.

"We had a continuous flow of news stories on the soil survey from start to finish," Fishbeck said.

"Soil surveys can be overwhelming the first time a person looks at one," said Eacker. "When I tell people how to use a soil map, I compare it to a jigsaw puzzle. With this method I can quickly explain how to use the soil map in a way people can easily understand."

"The County Public Health Department was the strongest user of the early soil maps," said Neil Stroesenreuther, assistant State soil scientist in East Lansing and soil survey party leader for the Washtenaw County Soil Survey from 1968 to 1973.

"I was called on at least three or four times a week to help the department identify and evaluate soils with questionable permeability for septic tank filter fields."

Stroesenreuther also helped train County Public Health Department sanitarians in using soil maps to make preliminary evaluations of sites for septic tank filter fields. He briefed them on soil descriptions and the soil survey and took them to the field so they could see how the soil scientists make soil investigations and the soil maps. He showed them how to identify different soils and what characteristics to look for in evaluating them for septic tank filter fields.

"Now we always use the soil maps to make preliminary evaluations of sites for septic tank filter fields," said Public Health Engineer Barry Johnson. "The soil maps tell us how extensive site investigations need to be and what we might expect.

"I remember a case where a house was built on a hillside in the summer and the next spring the owner

At right, "It's not a swimming pool" read an Ann Arbor newspaper caption for a photo of this basement excavation. Washtenaw County residents want copies of the soil survey to avoid problems like this. Far right, soils information helps developers and others select suitable sites for new homes, especially when onsite waste disposal is needed.

couldn't keep the basement dry with two pumps," Johnson said.

"The developer wanted to build six more houses in the same area. But, based on the information in the soil survey and our own investigations, we opposed it. The developer finally agreed to install an observation tube where we could watch the water level for a year before making a final decision. The next spring, water started coming up in the tube. It finally came to within a foot of the surface and the developer was convinced. He changed the grading and ditching plans to allow for proper drainage and we approved the new plans.

"Six new houses were saved from water problems," Johnson concluded.

As the SCS soil scientists and soil scientists from the Michigan Agricultural Experiment Station completed the field work for the survey, radio, television, and newspapers reported their progress and findings.

"It's not every day that a city gets something named after it, even if it is dirt," read a lead for an Associated Press news article. The article told about a new soil the scientists discovered and named Ypsi sandy loam after Ypsilanti, Mich.

Many of the news stories focused on specific soil problems and how soil surveys can help in making wise land use decisions.

The Washtenaw County Planning Commission used the soil survey information in making maps that show interpretations of the survey data, for example, the yield potential on different soils for corn.

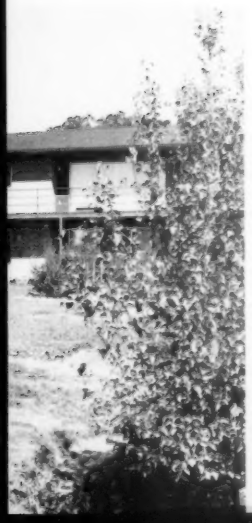
The commission also used the information in drawing up a proposed long-range land use plan for the county.

Until the completed soil survey report became available in August 1977, interim soil survey reports were widely used.

The popularity of the Washtenaw County Soil Survey was sparked by: a need for an up-to-date inventory of the soils; use of interim soils reports; land use changes; a desire to preserve prime farmland; and a good information program that kept people aware of the soil survey, its value, and uses.

"People are using the soil survey because our information program made them aware of it," Eacker said. "I don't think use of the Washtenaw County Soil Survey or our soils information program have crested yet. I don't think they ever will. We will always find new uses for the soil survey."

Mr. Howell is public information officer, SCS, East Lansing, Mich.



SCS District Conservationist Clark Eacker uses his jigsaw puzzle method to explain the use of soil surveys to Maria Ittner, a student at the University of Michigan. Ittner needs the soils information for a forestry class.

High and Dry, Thanks to Soil Survey

by Charles L. Hammond

Using soil surveys before planning construction of their new courthouse saved Nebraska county commissioners from future trouble with flooding.

A beautiful new Madison County, Nebr., courthouse is sitting high and dry because the information provided by a detailed soils map was used at the right time.

In 1975, when Madison County was planning to build a new courthouse, Paul Terry, chairman of the county commissioners, went to the Soil Conservation Service to request that a detailed map of the soils be made on the proposed site of the courthouse.

"A site had been selected for the new courthouse because of proper zoning and its proximity to a central sewer system," said Terry, "but the elevation was a little low. I had heard about soil surveys and thought we should have one to avoid any trouble in the future."

Interpretations in soil surveys tell which soils are suitable for supporting a building and which soils require special treatment in preparation for construction and grading. The county commissioners wanted the soil survey information before they planned construction of the courthouse.

Soil scientists dug several holes at the proposed site and examined the soil for permeability, topsoil thickness, depth to bedrock, variance of the water table, soil texture, and drainage.

From their analyses, the soil scientists determined that the dominant soil type was Gibbon silty clay loam. The soil was deep, nearly level, and somewhat poorly drained, on occasionally flooded bottom lands. The water table fluctuated from a depth of 2 feet in wet years to below 6 feet in dry years.

The soil scientists reported to the county commissioners that the main hazards to development on this soil would be occasional flooding and wetness. On the basis of this information, a suitable fill of 4 to 6 feet was used to raise the site above the water table and flood plain and the courthouse was built without a basement.

The soil survey conducted at the courthouse site is part of an ongoing survey of Madison County sponsored by the Madison County commissioners and the Lower Elkhorn Natural Resources District. SCS soil scientists are working with soil scientists from the University of Nebraska-Lincoln to complete the mapping for the survey by September 1979.

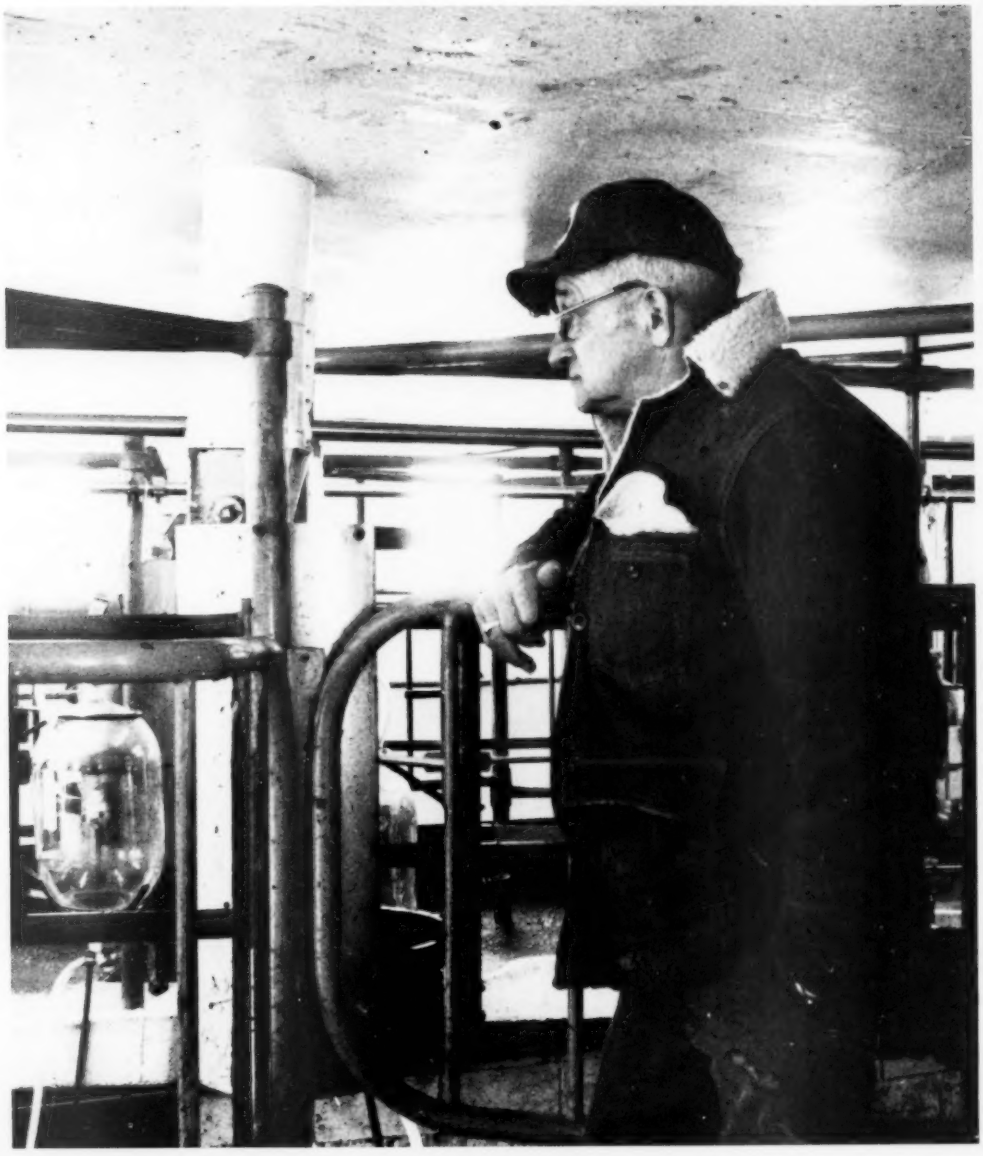
Mr. Hammond is a soil scientist, SCS, Norfolk, Nebr.

The county commissioners for Madison County, Nebr., used soils information to determine what site preparation was needed before construction began on the county's new courthouse.

Conservation Up. . . Profits Up

Through improved soil water management, a farm family in Vermont has raised their profits and lowered their operating costs.

by Ann H. Dudas



A cooperator with the Winooski Natural Resources Conservation District for the last 26 years, Verne Bissonette has overcome many obstacles in managing his farm through conservation planning.

Conservation planning has helped Bissonette increase his farm's yield of corn silage by 50 percent in tons per acre.

To reduce costs and increase profits is the goal of every wise business person. Farmers are no exception. They too strive to get ahead, yet fluctuating markets and increasing energy costs sometimes make it difficult for them to break even, let alone realize a profit.

But some farmers are managing well despite the obstacles. In Vermont, Verne J. Bissonette in Chittenden County is one of them.

"We've been cooperators with the Winooski Natural Resources Conservation District since 1952, and for the past 26 years we've followed conservation plans we developed with help from the Soil Conservation Service," said Bissonette.

Verne and his son Wayne operate in partnership a farm that has been in the family for almost 60 years. It was originally purchased in 1919 by Verne's father Joseph, who transferred ownership to Verne and his wife Daisy in 1946. Over the years, several neighboring farms were incorporated into what now makes up the Bissonette farm. There are 620 operating acres; the Bissonettes use 495 acres and rent the rest.

They have 182 acres in pasture, 148 acres in cropland and hayland, 158 acres in woodland, and 7 acres in depressions along streams in wildlife land. Out of their herd of 233 cattle, 137 are milkers which produce more than 1.5 million pounds of milk a year.

Today, four generations of Bissonettes, from Joseph on down to his great grandchildren, live on the farm. While Verne and Wayne tend to the manual labor, Daisy maintains the books with the air of an accountant.

"I was off 3 cents last year and that really bothered me. I looked everywhere, but I couldn't find it. This year I wasn't off even a penny," she said.

While Daisy might have "lost" 3 cents balancing her books, the profits she is able to show more than make up for it. In the past 2 years, the farm's yield has increased 50 percent in tons per acre of corn silage as a result of practicing conservation.

Before they installed their soil water management system, the Bissonettes had problems with excessive wetness on their cropland and hayland because of the seasonal high water table and poorly drained soils. They needed to lower the water at the surface 6 to 12 inches to enable plant roots to develop properly. They were also having problems with their heavy farm equipment getting stuck in the mud.

To control the soil saturation, SCS helped the Bissonettes design surface ditches, subsurface drains, and grassed waterways to remove excess water from their cropland and hayland.

Under the Agricultural Conservation Program, the Agricultural Stabilization and Conservation Service provided the Bissonettes 50 percent cost sharing on the ditches and waterways.

The surface ditches are 2 to 3 feet deep. The bottoms of the ditches are lined with stone to prevent scouring and the banks are seeded with Kentucky 31 fescue, timothy, and clover. Red fescue, redtop, and reed canarygrass are planted close to the water line.

In areas of heavy silt, the Bissonettes installed subsurface drains. They dug trenches 2½ to 3 feet deep; backfilled them with a layer of gravel; laid flexible, corrugated plastic tubing; and then covered the tubing with about 1½ feet more of gravel. The subsurface drains carry water to stone headwalls and the water is directed to existing watercourses.

Grassed waterways also safely carry runoff from fields to suitable outlets. Some grassed waterways are used as outlets for surface ditches.

A severe drought in the summer of 1977, followed by a record rainfall in the autumn, raised havoc with the crops on neighboring farms. Corn growth was stunted and what survived ended up rotting in the fields from excessive moisture. However, the Bissonettes were able to salvage nearly 70 percent of their normal corn silage because the ditches and grassed waterways carried the excess moisture off the fields.

The installation of surface and subsurface drains also made it easier to run machinery on the poorly drained soils and enabled the Bissonettes to reduce their operating expenses by 25 percent.

As conservation-minded farmers, the Bissonettes also rotate grazing on their pastures to prevent overgrazing, improve grass production, and minimize erosion. On their cropland and hayland they use a 4-year rotation of 1 year of corn or

Drought, followed by a record rainfall, raised havoc with corn crops on neighboring farms, but the Bissonettes salvaged 70 percent of their normal corn silage because of their conservation measures.

The Bissonettes plan to continue in their conservation efforts which have helped them protect the soil and increase their farm's production.

oats followed by 3 years of forage crops. The forage crops include 'Pennscot' red clover, timothy, 'Viking' trefoil, and alsike clover. In fields with high pH, they grow saranac alfalfa.

As part of timber stand improvement on their woodland acres, SCS helps the Bissonettes use soils information to determine which trees are most suited to the soils and climate.

Besides gaining financially, the Bissonettes discovered that conservation planning also adds to their family fun. Referring to a pond designed and installed according to their conservation plan, Daisy said, "We really enjoyed 'just getting away' for picnics up there. We've even stocked it and the kids have a grand time fishing in it."

The wildlife land that the Bissonettes preserved along streams attracts muskrats, beavers, woodchucks, mallards, wood ducks, and teals.

Always looking toward the future, the Bissonettes have an idea for making their farm even more profitable. Realizing the potential of nutrients in animal waste, they hope to build an agricultural waste facility. That way they can store manure from their feedlot through the winter months and plow it under in the spring without losing much of its fertilizer value. Because bedrock is so close to the soil surface, their storage facility will have to be above ground.

"With a waste facility," Verne explained, "we'll save money because we won't have to start that big tractor every day to spread the waste."

Another money-saving plan is to convert some of their cornland to hayland. The Bissonettes know that on some of their land, hay will produce acre for acre more digestible protein for their herd.

In 1977, the Winooski Natural Resources Conservation District chose the Bissonettes to receive the Conservation Farmer of the Year award for Chittenden County.

When asked what he thought of the conservation program for his farm, Bissonette replied, "You need one because there aren't any two farms that can be farmed the same way."

Daisy summed it up when she added, "Over the years, we've met a lot of really nice people and we've had a lot of help."

Ms. Dudas is editorial assistant, SCS, Burlington, Vt.

In the Colorado mountains, wagon wheel ruts eroded into deep gullies. Critical area treatment finally put a stop to the 100-year-old erosion.

Pulling the Reins on Mountain Gullies

by Joseph J. Alessi

Erosion increased rapidly in Custer County in south-central Colorado when the first settlers moved into the fragile mountain environment in the 1870's. In order to bring supplies into the area, wagons moved up the valleys cutting deep ruts with their heavy loads. When one road became impassable, the wagoners moved over until several ruts were worn into the ground.

In this area, summer is the season of high-intensity thunderstorms. The rain falls on the watershed, races down steep inclines, cuts away the topsoil, and deposits it as sediment downstream. Gradually through the years, erosion has turned the wagon ruts into deep gullies and arroyos.

The subwatershed above Tyndall Gulch, which lies 2 miles northwest of Rosita in Custer County, is a combination of private and Federal lands. The Federal land is administered by the U.S. Department of the Interior's Bureau of Land Management (BLM).

BLM and Custer County wanted to control erosion in the area and prevent sediment from being carried into Grape Creek, the Arkansas River, and eventually from filling the sediment pool of the new Pueblo reservoir and dam. In 1973, they requested assistance on an erosion control project from the Soil Conservation Service through the Custer County-Divide Soil Conservation District. The project was authorized for assistance under the Sangre de Cristo Resource Conservation and Development (RC&D) Area.

SCS engineers submitted surveys, designs, and cost estimates for various solutions to the erosion problem. BLM and Custer County selected the alternative they wanted, deciding to start the critical area treatment at the crest of the hill where water spilled down from a 95-acre subwatershed.

Erosion had created four gullies in Tyndall Gulch's channel. The main channel was 20 feet deep and the side gullies were 10 feet deep. At the beginning of the project, all the gullies were cored out and backfilled with compacted earth. Shaping and seeding was done along a half-mile stretch downhill.

Seven level terraces were constructed to hold floodwater and let it seep slowly into the soil. The terraces range from 720 to 1,223 feet long. They are from 1½ to 4 feet high, each about 30 vertical feet apart.

About halfway down the hill, a 20-foot-high dam was constructed to slow runoff water. When the dam is filled with water, two ditches carry the overflow onto a seeded area below at nonerosive velocities. On the downhill side of three road culverts, the county installed and paid for three concrete culvert spilling basins.

Twenty acres were seeded to adapted grasses in a mixture of milkvetch, crested wheatgrass, slender wheatgrass, and bromegrass. To protect the exposed site from livestock, 5,676 feet of fencing was constructed.

SCS Project Engineer Bill Snyder and Construction Inspector Gilbert Mondragon encouraged the contractor to leave trees or vegetation where possible to accelerate the healing of the area.

On the private land, Custer County paid 20 percent of the construction costs and RC&D funds covered the remaining 80 percent. BLM paid all the construction costs on its land. RC&D paid the costs for technical services and project administration not included in the project's contract.

The critically eroding area is now well on the way to recovery, reducing the damage to the site and the downstream areas.

Mr. Alessi is RC&D coordinator, SCS, Pueblo, Colo.

Far left, old wagon roads used by settlers in the Wet Valley Mountain area in Colorado in the 1870's had eroded into deep gullies. Near left, through critical area treatment, the historic scars are healing well, reducing erosion and sedimentation.

Family Style Conservation

by Ernest A. Busek

From sand dunes in their wheat fields, a Montana family has built a conservation showpiece on their Great Plains ranch.

Back in the early 1950's, the Mothershead family had a goal: to install conservation practices on their 3,200-acre ranch in eastern Montana. They also faced a challenge because the sandy wheatland suffered from severe wind erosion.

"Did this land blow? You bet it did," said Bob Mothershead. "In one field, we had to use a blade to level the sand dunes so we could plant trees for a windbreak."

The family planted 14,000 trees—Siberian elm and Russian-olive—in rows through the field and around the farmstead. The trees plus a good stubble mulch protect the soil from the Montana prairie winds. Today the dunes are gone.

A white-tailed deer ghosts into the cover of the trees, disturbed by human visitors. Sharptail grouse, songbirds, and other wildlife also are attracted to the tree-covered area.

The trees are impressive, but the Mothershead family has installed other conservation practices on their beef cattle and small grain operation in McCone County.

Wind stripcropping—alternate strips of wheat and fallow—protect other fields. The Mothersheads also keep crop residue on the surface of fallow strips to further protect the soil from blowing.

On sloping fields, the family uses contour strips to lessen the chance of water erosion. They also established grass buffer strips on these fields. They graze the grass buffers or cut them for hay.

On an intermittent stream that winds through the ranch, the Mothersheads built a dam to store runoff water that is normally lost in this low rainfall area. Pumped into a system of dikes, the water irrigates 80 acres of hayland.

The family built stockwater developments on the rangeland to distribute the Hereford cow-calf herd for better conservation of the native grasses, which also provides higher quality grazing.

This conservation showpiece took a lot of hard work and planning. After the Mothershead family purchased the ranch in 1950, they became cooperators with the McCone County Conservation District (CD). Later, working through the district, they signed a Great Plains Conservation Program (GPCP) contract with the Soil Conservation Service. Under the GPCP, SCS provides technical assistance and cost sharing for specified conservation practices.

"The Great Plains Conservation Program was certainly a big help for us in getting the things done that we wanted to do," said Bob. The Mothersheads completed their Great Plains contract in 1966 and still work to maintain the conservation practices they installed.

Even though the Mothersheads have completed their GPCP contract, their conservation story continues. In 1964, they leased another ranch with more than 1,200 acres of deeded land and nearly 9,000 acres of grazing land owned by the Bureau of Land Management, the State of Montana, and the Burlington Northern Railroad.

After they purchased the deeded land, they worked with SCS personnel to develop a conservation plan. In 1977 under the plan, they constructed a stockwater dam and developed two springs to complement the other water developments and grass seedings previously carried out.

Randy Mothershead working at the site of a stockwater dam he and his family built on their ranch in Montana.

In 1965, shortly before the Mothershead family completed their GPCP contract, the McCone County CD presented them with the Conservation Farmer of the Year award.

The Mothersheads are proud of the conservation work they have accomplished through the years. "It's only natural," explained Bob, "for a family that believes land must be cared for so that it can be used for future generations."

Mr. Busek was district conservationist, SCS, Circle, Mont., and is now district conservationist at Hamilton, Mont.

Managing Crop Residues

by Bethel C. DuRant

Leaving residues in grain fields protects the soil from erosion and provides food for wildlife.

"If you really want to cut down on soil erosion in your grain fields, just leave the harvest residue on the land in the fall," said Gordon Wells, a Jasper County, S.C., farmer.

Wells knows from experience that properly managed residue makes sense in more ways than one. He says that leaving the land covered in winter rather than burning it or disking it immediately after harvest helps cushion the explosive effect of falling raindrops and makes more water soak into the soil.

He also says that he improves his surface layer and prevents extreme changes in soil temperature by leaving the residue.

"I usually bush hog the corn stubble to make it rot quicker. This also shreds the weeds and grasses that have come up after the herbicide has lost its effectiveness.

"People don't realize that erosion is a problem on our flat land down here," Wells explained, "but the truth is, we have very little acreage around here that won't erode in a heavy shower or blow in the spring when it's bare."

Wells, who serves as a commissioner of the Jasper Soil and Water Conservation District, is quick to point to additional values of crop residues.

"I'm an outdoorsman," he said, "and the wasted grain provides ideal food for wildlife." He goes a step further in encouraging wildlife by leaving narrow, unharvested strips of corn or beans around the field edges to provide food and cover for deer, quail, and doves.

When asked about increasing disease and pest problems as a result of leaving the residue in his corn and beans, Wells says he hasn't had any. However, he watches closely for these problems and realizes that he might have to use some other methods, such as a winter cover crop or rowbedding on the contour, to save his soil.

Mr. DuRant is district conservationist, SCS, Ridgeland, S.C.

Gordon Wells (left), a district commissioner in Jasper County, S.C., leaves crop residue on his fields in the fall to protect the soil from erosion through the winter. He discusses the benefits of residue management with SCS District Conservationist Bethel DuRant.

Burying Your Home to Save Energy?

Better Check the Soil First

Burying homes in hillsides or placing them underground may save energy, but you'd better check the soil first, according to a Soil Conservation Service soil scientist.

"Floods pose the biggest hazard," said David F. Slusher, SCS soil scientist. "In a conventional home, a flash flood may be an inconvenience; in an underground dwelling, it's a disaster.

"Sliding soils are a close second as a hazard. Even a small landslide could cover up your front door and air supply."

Soils that may flood or slide are described in SCS soil surveys, which are available from local SCS offices.

"Soil surveys also help homebuilders spot other buried-home hazards, such as high water tables, high acid or sulfate soils that corrode concrete, and soils that shrink or swell. But surveys can be used for more than trouble shooting. They can help prospective builders find sites with soils and slopes suitable for buried homes."

Slusher says that homebuilders should consider in advance where to put waste disposal facilities.

"If you have to use a septic system, you want a lot with a level stretch of land downhill from the home for the septic fields," he said. "Otherwise, you have to pump the sewage uphill and that would use some of the energy you're trying to save."

Another consideration, according to the soil scientist, is growing grass and other plants over the house. While this practice helps control soil erosion, improves the land's appearance, and saves energy, it can also be a problem.

"You would need at least 2 feet of good loamy soil over your house to support a lawn," Slusher advised. "That means having an engineer make sure that your roof will support that weight of soil.

"If I were going to build a buried home, I'd begin with an SCS soil survey to get a general idea of soil

At left, this buried home in West Virginia wasn't planned that way. The landslide covering the home isn't a mine spill, but soil from an undisturbed 40 percent slope. An underground home in this type of soil might vanish without a surface clue to its location. At right, frequent floods may help control anthills around this South Carolina house, but a buried home in such soil would probably suffer the same fate as the anthills.

limitations and potentials. Then I would dig a hole at the site as deep as I'm planning to build and see what's down there. I might hit bedrock after 8 feet; there could be water down there.

"Whatever the circumstances are, I'd want to know about them before I spent a dime of construction money."

The scientist's interest in buried homes was sparked by stories in several newspapers and magazines, which referred to underground private homes and office buildings, and even plans for a penitentiary buried in a hillside.

Meetings:

October	
1–6	Water Pollution Control Federation, Anaheim, Calif.
6–10	American Horticultural Society Congress, Nashville, Tenn.
8–10	American Forestry Association, Hot Springs, Ark.
11–13	American Water Works Association, Chesapeake Section, Norfolk, Va.
14–17	Farm and Industrial Equipment Convention, Boca Raton, Fla.
14–18	Congress for Recreation and Parks, Miami Beach, Fla.
16–20	American Society of Civil Engineers, Chicago, Ill.
17–20	National Conference of Editorial Writers, Detroit, Mich.
21–25	American Bankers Association, Honolulu, Hawaii
23–26	The Geological Society of America, Toronto, Ontario, Canada
25–27	Adult Education Association of the United States of America, Portland, Oreg.
26–29	National Association of Biology Teachers, Chicago, Ill.
29–Nov. 1	The Irrigation Association, Palm Springs, Calif.
29–Nov. 2	American Association of State Highway and Transportation Officials, Louisville, Ky.

November	
7–10	Future Farmers of America, Kansas City, Mo.
10–13	National Agricultural Plastics Association, Miami Beach, Fla.
12–15	National Association of State Universities and Land Grant Colleges, St. Louis, Mo.
12–15	National Forest Products Association, Palm Beach, Fla.
12–16	American Institute of Chemical Engineers, Miami, Fla.
13–17	National Conference on Urban Forestry, Washington, D.C.
13–20	The National Grange, Denver, Colo.
19–22	American Society of Landscape Architects, Atlanta, Ga.
29	No-Tillage Systems Conference, Griffin, Ga.

December	
3–6	American Society of Farm Managers and Rural Appraisers, Inc., New Orleans, La.
3–8	Joint Meeting of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, Chicago, Ill.
4–8	American Geophysical Union, San Francisco, Calif.
5–7	Western Forestry and Conservation Association, Sacramento, Calif.

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